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The Expedition of the "Meteor"

The issue, as a reprint from the *Zeitschrift der Gesellschaft für Erdkunde, Berlin*, of the fourth section of the preliminary report of the German Atlantic Expedition in the "Meteor," which carries the account up to the return of the vessel into home waters, calls for a short notice of the objects and achievements of this successor of the "Challenger" and the "Gazelle." The "Meteor" expedition owed its inception to the late Dr. Alfred Merz, who in the course of many years study of observations of oceanic temperature and salinity had developed a new theory of the oceanic circulation. Merz considered that the old idea of a circulation in two halves, nearly symmetrical about the equator, extending from the surface to the bottom, with the water rising near the equator and descending in high latitudes, does not fit the facts, and he formed a picture of an exchange of water between the northern and southern hemispheres, the stream lines crossing the equator generally horizontally, a circulation of the old type being found only in the surface layer of about 150 metres depth, and then only within the tropics. The new theory, however, was based on only few and scattered observations of temperature and salinity, which were especially scanty at depths greater than 1,000 metres, and Merz wished to test it by means of a comprehensive series of observations at all depths.

The first proposal for the expedition was made in 1919, and was warmly supported by the German Admiralty, the recently-

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built gunboat " Meteor " being allocated for the work. In 1920 Merz brought forward plans for a three-year voyage in the Pacific, but at that time financial conditions were too stringent, and it was not until 1924 that the expedition was sanctioned in the more limited form of a two-year expedition in the Atlantic. The plan was still built around the investigation of the oceanic circulation, and included a series of fourteen voyages across the Atlantic, more or less parallel with the lines of latitude, between 20° N. and the northern edge of the Antarctic ice, which the " Meteor " was not built to withstand. On each of these transverse voyages soundings were to be made at a number of points, to determine the temperature and salinity at all depths, and where possible to obtain actual measurements of the current at different levels. In this way Merz hoped to bring all important branches of the great inter-hemispherical circulation into his scheme. The hydrographical part of the work was to be completed by detailed measurements of the rainfall and evaporation, to determine the balance of movement of water across the surface. Then if the accessions of water from rivers and the melting of land ice could be estimated, for the first time the water exchanges of a great ocean would be known. With regard to the heat exchanges Merz was less sanguine, but he proposed a system of measurements of the incoming and outgoing radiation. Further, a meteorological station of the first order was to be erected on deck for continuous registration in the lower layers of the atmosphere, while the higher layers were to be investigated by means of pilot balloons, registering balloons and kites, so that the study of the atmospheric circulation would go hand in hand with that of the oceanic circulation. The opportunity would also be taken for studies of marine biology, geology and chemistry.

This programme, ambitious though it seemed, was fully realised; all was ready in January, 1925, and on the 20th of that month the " Meteor " set out on a trial expedition to Teneriffe and Madeira, returning on February 17th. As a result of the experience gained on this trip a number of minor alterations were carried out, and on April 16th, 1925, the ship started on the expedition proper. The equipment, both human and instrumental, was very thorough. In addition to Dr. Merz, the leader, there were four oceanographers, a geologist, a biologist, a chemist and two meteorologists (Dr. Reger, of Lindenberg, and Dr. Kuhlbrodt, of the Deutsche Seewarte), while many of the ship's officers also took part in the scientific work, such as observations of terrestrial magnetism and atmospheric electricity. The meteorological arrangements are of special interest. The screen was placed on the roof of the chart-house on the bridge, but as it was doubtful if this exposure would be satisfactory,

four resistance thermometers were installed in different situations, one being at the head of the foremast at a height of 28 metres. In addition, observations were taken regularly with an Assmann psychrometer. Three anemometers were installed, that on the foremast being 31 metres above the sea. There were three barographs with monthly, weekly and three-day clocks for studying pressure waves of different periods. A complete set of eye observations was taken regularly three times daily, and in addition hourly observations of wind, cloud, etc., were made from the bridge.

The " Meteor " reached Buenos Aires without incident, and on June 3rd set out on its first " profile " across the Atlantic, in latitude 42 degrees south. But at the fifth sounding station Dr. Merz, who had been ill for some time, became so much worse that it was decided to return to Buenos Aires in order that he could receive proper medical care. He never saw again the expedition which he had done so much to make possible, for he died on August 16th, at the early age of 45. Meanwhile, the interrupted voyage had been resumed under the leadership of Captain Spiess, while the oceanographical observations were under the charge of Dr. Wüst. Space will not permit us to follow the crossings in detail; it is sufficient to remark that the plans of the expedition were carried out in full, the fifth crossing being from west to east in latitude 55° S., with deviations southward to Deception Island off Graham Land, and to the point 63° S., 5° E., the thirteenth and fourteenth crossings north of the equator between northern Brazil and the Cape Verde Islands. In all temperature and salinity soundings were made at 310 " stations," while 67,300 echo soundings gave a greatly improved picture of the topography of the Atlantic. The party returned to Wilhelmshaven on May 29th, 1927, after a journey of 67,500 nautical miles.

It is too early yet to be able to say much about the scientific results of the expedition, but it seems certain that the oceanographical theories of its founder are confirmed. The third report contains diagrams* showing the distribution of salinity and temperature along two sections from the Antarctic Continent to the equator, in the eastern and western Atlantic basins respectively. Apart from the shallow surface layer of warm saline water between the equator and about 40°, these show three main streams. From the Weddell Sea two streams move northward; the Zwischenstrom (Intermediate Current) consisting of water of very low salinity resulting from the melting of ice, travels along the surface as far as 40° S., and then dives under the equatorial surface layer, while the Bodenstrom (Bottom Current), consisting of water of moderate salinity but very low

*Zs. Ges. Erdk., Berlin, 1927, pp. 132-3.

temperature, travels northward along the ocean floor, but penetrates as far as the equator in the western basin only. Between these two northward flowing currents is the Tiefenstrom (Deep Current) of high salinity but moderate temperature, flowing southward across the equator between depths of 1,500 and 3,500 metres. The minor details of the circulation are governed to a very great extent by the topography, a relationship which also was foreseen by Merz.

The meteorological part of the work seems to have been carried out as thoroughly as the oceanographical part. In all 812 pilot balloons were sent up, an average of more than one a day. Some of the crossings were in very cloudy regions, and in order to make use of favourable gaps in the clouds large balloons were employed. At first the balloons were generally given an ascensional velocity of 400 metres per minute, but later it was necessary to reduce this owing to the deterioration of the balloons. Three hundred and sixty balloons reached 5,000 metres and 194 reached 10,000 metres, while several exceeded 20,000 metres. In addition, kite ascents were made on 217 occasions, but only a few successful ascents of registering balloons could be made. No summary of this great mass of material has yet been published, but the expedition is said to have shown that the variability of wind conditions in the tropics is much greater than was hitherto supposed, and that there is no anti-trade in the old sense. The importance of the material consists not only in its amount, but in its systematic spacing, and when full results are available they should throw new light on many other problems of the atmospheric circulation. Thus, both on the oceanographical and aerological sides the full plan of the expedition will have been abundantly completed, and though the chief architect did not live to reap his triumph in person, the results will be a lasting memorial to his name. C. E. P. B.

An Historical Catalogue

The traditional quiet domestic life of King George III. and his consort is well illustrated by the interest they showed in science. The Office of Astronomer Royal was filled for the greater part of the reign by Nevil Maskelyne, and on two occasions at least their Majesties visited Greenwich. From the year 1782 William Herschel was working near Windsor under the direct patronage of the King, with a salary paid from the Royal private purse, and, it has been said, though the evidence is insufficient, with the title of Royal Astronomer. Twelve years before the discovery of Uranus there had been a King's Astronomer, Dr. Stephen Charles Triboudet Demainbray, who was in charge of

the King's Private Observatory at Richmond, in Surrey, and was succeeded in that office by his son about the time of Herschel's achievement, so there were three workers in the celestial science, each with a regal title.

The history of the foundation of the King's Observatory is told briefly in a memoir with the lengthy title " An old catalogue, and what it tells us of the scientific instruments and curios collected by Queen Charlotte and King George III.," by Mr. R. S. Whipple,* brother of the present Superintendent of the Kew Observatory, which is the modern name of the buildings established by King George. Dr. Demainbray, who was born in England but was of French Huguenot descent, had been taught some science by Dr. Desaguliers at Westminster school, and adopting scientific study as a career, himself lectured in turn at Edinburgh and Dublin and then at various places in France, where he made a great reputation. In 1754 he returned to England to act as tutor to George III. when Prince of Wales, and also to Queen Charlotte before her marriage in 1761, and it was doubtless due to his inspiration that these royal personages acquired the taste for science that led to the building of the King's Observatory at Richmond shortly before the Transit of Venus of 1769. That observatory was maintained at the expense of the British Government until 1841, when it was decided that its upkeep should be discontinued. The building passed into the hands of the British Association and became what has since been known as the Kew Observatory, and its contents were distributed amongst various institutions and individuals. Several of the astronomical instruments were sent to the Armagh Observatory, instruments of various kinds to King's College, London, curios and specimens to the British Museum and to the College of Surgeons, whilst some of the articles passed into the possession of private individuals. Among the latter was the catalogue here spoken of, which by good chance was preserved by the family of Stephen Peter Rigand, Savilian Professor of Astronomy at Oxford and Radcliffe Observer, who was a grandson of Dr. S. C. T. Demainbray. It was presented by his son to the Kew Observatory in 1855.

This is the history of the catalogue that has lain among the archives of the Observatory since that date, and has now been made available for general inspection by Mr. Whipple. The original is in manuscript on twenty-three foolscap pages, a photographic copy of the first of which is given. The main catalogue is a list comprising 322 items, described as " the Philosophical (*sic*) Instruments Her Majesty has deposited in the Royal Observatory at Richmond and to this is added

* Reprinted from the *Proceedings of the Optical Convention*, 1926. Aberdeen University Press.

a list of 76 presents, made by Sundry Persons to Her Majesty's collection," the latter being almost entirely animal or mineral specimens, or other curiosities that might have been brought from foreign parts by travellers. The collection of philosophical instruments was apparently begun by Dr. Demainbray in 1740, and was put at the disposal of the Royal family when he became connected with them, and was added to as time went on. Among the optical items are models showing the paths of light rays through lenses and lens systems by means of coloured threads; Scioptric balls used for illuminating microscopes or other instruments, the ball being mounted in the frame of a window; specimens of a kind of toy called Polyoptric pictures whose purpose it is to make distorted or disjointed pictures complete by optical means. As to other sciences there are pieces of apparatus to illustrate mechanical pneumatic and hydrostatic principles and miscellaneous models and pictures that need not be particularized. Entry No. 78 is an electrical machine and apparatus which with Hawkbee's large electrical machine (No. 6) are the only items relating to the new science.

Mr. Whipple claims our gratitude for having brought to light this evidence of popular knowledge in the middle of the eighteenth century. He has, moreover, given descriptions of some of the more obscure with pictures that he has been able to obtain from the instruments that are now at King's College, but possibly the most entertaining pages are those that describe the observations of the Transit of Venus of June 3rd, 1769, made at Richmond Observatory, now published, it is believed, for the first time by the courtesy of the Delegacy of King's College, who put a manuscript notebook written by Dr. Demainbray, now in their library, at Mr. Whipple's disposal. The entry of the planet on to the disc took place about an hour before sunset. The King and Queen with two serene Highnesses, Col. Desaguliers, a son of the Doctor, a favourite at Court, and the Rev. Mr. Wollaston went to Richmond, and all except the Queen observed the phenomenon. His Majesty used a short reflector which may be that with a 6-inch mirror now at Armagh. In the words of the record he "was the first who saw the penumbra of Venus touching the edge of the sun's disk." He indicated this to Dr. Demainbray who was attending His Majesty as time-recorder and using a Shelton clock, of which there were several in the Observatory, whose error and rate had been previously determined. The mean time of first external contact was found to be 7 h. 7 m. 55 s. according to the King's observation. Col. Desaguliers and the Rev. Mr. Wollaston who were attended by Benjg. Vulliamy to mark the exact time, saw it within half a second of His Majesty, and Messrs Sisson, Vulliamy Sen. (Justin) and Cuff (who were

in the upper dome room) rang a bell to give notice of their seeing it, nearly at the instant Col. Desaguliers and the Rev. Mr. Wollaston spoke. Their serene Highnesses, Prince Ernest and Prince George, attended by Mr. Stephen Rigand saw it last as they were in a separate apartment. They were heard to call out as the Dome bell rang. The following notes are added in red ink to these observations of first contact in the record. "The interval of these times could not exceed one second. I (Dr. Demainbray) must also add that His Majesty thinks he saw it before he gave his signal to Dr. Demainbray who attended at the regulator, and that Mr. Sisson (fearful of giving a false alarm) waited an instant before he caused Mr. Cuff to ring the bell."

It might be said, judging from the accordance, that the observing was particularly good, or on the other hand it may have been that his loyal subjects waited for the King to declare the event, and then supported him whole-heartedly. The internal contact appears not to have been observed with such unanimity. The sky was cloudless and these distinguished observers apparently saw the "black drop" though they did not call it so, but Dr. Demainbray says that the vapours near the horizon did not admit of the body of Venus to appear perfectly circular but caused rugged asperities round the edge which created, he presumed, inequalities in the times of judging of the contacts and gives the time of first internal contact 7 h. 25 m. 44 s. not saying how this was arrived at. A final note states that the observers in turn saw through Dollond's achromatic telescope a ring of coloured light round Venus when on the sun, like a faint rainbow.

These observations can scarcely be of scientific value, but Mr. Whipple is to be thanked for having unearthed them and published the account as a complement to this catalogue which together throw an interesting sidelight on a Royal hobby.

H. P. Hollis.

The Visibility of Coloured Tails in Pilot Balloon Ascents

It has been found in practice under ideal conditions that the tail method of obtaining the height of pilot balloons is almost as accurate as the double theodolite method. In the former method the tail consists of a sheet of white foolscap of dimensions about 12 in. by 8 in., wired with aluminium wire along the upper edge and gummed along the lower edge and connected to the balloon by a double length of cotton thread. The length from the centre of the balloon to the centre of the pendant is 30 feet or 60 feet according to the height required to be measured. A 30 foot tail gives good results up to 8,000 feet. For greater

heights than this a 60 foot tail would be necessary. This method is fairly accurate when used where :—

1. The wind is fairly strong so that the angle of elevation of the balloon does not exceed 30° or 40°.

2. The tail is steady having little or no oscillation in the vertical plane.

3. The pendant shows up distinctly so that the observer is enabled to read accurately the apparent length of the tail on the micrometer in the eye-piece of the theodolite.

In this note the writer is only concerned with the third condition above. To facilitate the reading of the tail in the eye-piece of the theodolite different coloured pendants were introduced for use with different backgrounds. Pendants coloured in red, white, silver and black on one side with a polished surface, together with the ordinary sheet of white foolscap were recommended for use to stations where tail ascents were regularly carried out. At Larkhill most tail ascents were, and even now under normal conditions are, carried out with the ordinary pendant of white foolscap. It was found desirable, however, to determine to what extent coloured pendants are an improvement over the ordinary pendant of white foolscap when used with different types of sky for backgrounds.

A series of ascents were made and it was arranged that all four types of pendants were used with each type of background in order that the visibility of each coloured pendant be compared one with the other. Four types of sky were chosen to include every sort of background likely to be met with during pilot balloon work at any station. They were :—

1. Blue (sky clear of cloud or with very fine cirrus or haze).

2. White (sky semi or wholly covered with cumulus forms).

3. Light grey (sky clouded by strato-cumulus or stratus types).

4. Dark grey (sky clouded by nimbus or stratus types).

Twenty-gram balloons of 70-in. circumference were used and these were filled with hydrogen to lift 70·7 gm. with the ordinary tail and white pendant. An extra lift of 3 gm. was given to allow for the coloured pendant in order to ensure a vertical velocity of about 500 feet per minute. It may be noted that a 70 in. balloon, filled to give the extra lift required when a coloured pendant is used, is just about filled to the limit of its capacity. In ascents where heights of above 8,000 feet are required involving the use of a 60 ft. tail a 90 in. balloon would be necessary. The balloons were followed until lost up to heights ranging from 2,000 to 8,000 feet according to the conditions of the sky. Under conditions 1 and 2 above we were

able to follow the balloons to heights between 4,000 and 8,000 feet; under conditions 3 and 4 heights below 4,000 feet only could be obtained except when the sky showed alto-stratus types only, when heights above this were reached. It was assumed that it would not be of any use to follow balloons with a 30 foot tail above 8,000 feet owing to the fact that the readings obtained by the tail method above this height do not usually give very reliable information as to the height of the balloon.

The visibility of the red, white, silver and black tails against each of the four backgrounds were considered in turn and the following are the results of the observations:—

RED TAIL.

Blue sky: The tail showed well up to about 4,000 feet after which the observer relied on the flashing of sunlight on the polished surface. Readings up to 8,000 feet have been obtained.

White sky: The tail could be seen distinctly until lost in cloud at between 4,000 and 5,000 feet.

Light grey sky: Ascents up to 4,000 feet were obtained, the tail being very distinct until lost.

Dark grey sky: The visibility of the tail was fairly good. Heights of about 2,000 feet were obtained.

WHITE TAIL.

Blue sky: The tail showed brilliantly white up to heights of about 8,000 feet.

White sky: The visibility was fairly good except when the tail showed against the shadows of cumulus cloud. Heights above 4,000 feet were obtained.

Light grey sky: The tail appeared dark grey and was quite distinct up to over 7,000 feet.

Dark grey sky: The visibility was only fair but sufficiently good up to 2,000 feet.

SILVER TAIL.

Blue sky: The tail was perfectly distinct up to about 7,000 feet but not nearly so clear when haze was present.

White sky: The visibility was fair up to 3,000 feet after which the observer had to rely upon the flashing of the silvered surface.

Light grey sky: The tail appeared dark and white alternately up to 3,000 feet after which it was seen in flashes of white.

Dark grey sky: The visibility was only fair until lost at about 2,000 feet.

BLACK TAIL.

Blue sky: The tail was fairly distinct up to 5,000 feet.

White sky: The visibility was very good until the tail was lost in cloud above 5,000 feet.

Light grey sky: The tail was quite distinct up to about 4,000 feet.

Dark grey sky: The visibility was poor to fair up to heights below 2,000 feet only.

It will easily be seen from the above that the ordinary white and red pendants are generally the most serviceable. The black and silver pendants need seldom be used since, under almost all conditions either the red or the white ones can always be seen with sufficient distinctness to allow observers to make accurate readings. In the ordinary pilot balloon work at Larkhill involving meteor reports for gunners results are only required to cover a maximum height of about 6,500 feet corresponding to a time of flight of projectiles of 40 seconds. For this purpose the ordinary white and the red pendants are the only ones really necessary, and in almost every case the white pendant only need be used. When wind readings are required at heights well above 8,000 feet, in which a 90 in. balloon and a 60 foot tail would be used, then the silver pendant would certainly be of use, for the flashing of the polished surface would help the observer to follow the tail.

The table given below is a summary of the observations described above and suggests the most suitable pendant to be used for the different conditions of sky.

Sky.	Pendant.
Clear Blue	Red when any haze is present. White up to 8,000 feet. Silver above 8,000 feet.
White..	Red.
Light Grey	White or Red.
Dark Grey	Red or White.

In conclusion, balloons coloured in red, white and blue, are usually supplied to stations, and, of the three, undoubtedly the red is the most suitable colour for general use.

M. J. THOMAS.

OFFICIAL NOTICES

Agricultural Meteorological Conference

The Annual Conference of observers and others interested in the Crop Weather Scheme will be held at the Meteorological Office, South Kensington, on Thursday and Friday, the 22nd and 23rd September, when papers will be read on various aspects of the work.

An account of the Conference of 1926 will be found in the *Meteorological Magazine* for October, 1926, p. 212.

Discussions at the Meteorological Office

The series of meetings for the discussion of recent contributions to meteorological literature, especially in foreign and colonial journals, will be resumed at the Meteorological Office during the session 1927-8. The meetings will be held on alternate Mondays at 5 p.m., beginning on Monday, October 10th, 1927, when Dr. G. C. Simpson, C.B., F.R.S., will open a discussion on "Recent Researches on Lightning in America."

The dates for subsequent meetings are as follows:—

October 24th; November 7th and 21st; December 5th, 1927; January 16th and 30th; February 13th and 27th; March 12th, 1928.

The Director of the Meteorological Office wishes it to be known that visitors are welcomed at these meetings. Tea is provided before each meeting.

Correspondence

To the Editor, *The Meteorological Magazine*

The Storms of July 10th—12th

A heavier rainfall was recorded in my rain-gauge as the result of the above-mentioned storm than is mentioned in your note in the *Meteorological Magazine* for August: the amount measured here being 4·10 in. for the 24 hours ending 9 a.m. (G.M.T.) on July 11th. Rather different amounts were recorded within a few miles of us: Col. Chrystie measured 1.77 in. at Shortheath (about 4½ miles to the west), and the Rev. H. R. Huband 3·5 in. at Ipsley Lodge (on the Hog's Back, about 1 mile to the north), as mentioned in the *Farnham Herald* for July 16th, 1927, which gives a full account of the storm in this part of Surrey. I have daily records of rainfall here since August, 1901; and the heaviest previous records were 2·39 in. on March 29th, 1917, and 2·22 in. on December 9th, 1914. I have no other records of over 2 in. in 24 hours. Our monthly rainfall here averages about 2½ in.; but there have been 24 records in the 26 years of over 5 in., five of over 6 in., one of 7·88 in. (December, 1911), one of 8·54 in. (October, 1903), and one of 9·22 in. (December, 1914). This June we had a rainfall of 5·07 in., and last month one of 5·83 in.

F. R. WALTERS.

Pinecroft, Crooksbury Ridge, Farnham. August 19th, 1927.

[The previous largest daily fall of rain on record in Surrey was 4·07 in. recorded at the Wisley on July 22nd, 1924. This appears to be the only fall exceeding 4 inches on record for that county.—J.G.]

I do not see it mentioned in the August Magazine that on July 11th there was practically no rain here. I only measured a

" trace " on the morning of the 12th, but on Tuesday, July 12th, there was a sharp thunderstorm with a downpour of rain between 4 and 5 p.m. B.S.T. I was out about one mile to the south-west where it rained heavily but nothing out of the way, but the men and maids here said they had never seen anything like it. Mould was washed out of the garden beds and gravel from the paths on to the lawn. Next morning, July 13th, I measured 1·14 in., which must have nearly all fallen in about an hour. I was told that at Faygate to the northeast, and Rudgwick to the northwest, no rain fell. ETHEL M. ALLCARD.

Wimblehurst, Horsham, Sussex. August 19th, 1927.

Lord Phillimore, in writing about the heavy rainfall in London of July 11th,* comments on the greater damage to the paths at Holland House (on the rising ground to the north of High Street, Kensington) than that at Cam House. The two gauges are only some 300 yards apart, that at Holland House recording 3·92 in., or ·50 in. more during the rainfall day than that at Cam House. At Cam House some of the gravel was washed clean of all the smaller sand and some garden earth was washed on to the paths. On the other hand, at Holland House deep cavities 3 ft. 6 in. deep and 3 ft. wide were washed in the paths. Two 9-inch walls were washed down with the pressure of water for a length of 70 yards. The rainfall during the actual storm of 2 hours is reported to have been 3.35 in. The mischief at both places was much less than that of the great storm of June 16th, 1917.

A report has also been received of a fall of 4·21 in. on the rainfall day of July 11th at Strinesdale, near Oldham. The storm was local, and was apparently confined to a width of about two miles, travelling up from the southwest and receding in the same direction. A heavy fall was also reported from Hanwell to the west of London, but the gauge was not of a standard pattern, and it is only possible to say that probably 4 in. of rain fell there. J. G.

The Cup Anemometer

The article by Mr. Vernon-Jones on the above subject in the August number of *The Meteorological Magazine* leads us to send a photograph of a three-cup anemometer which was constructed here some time ago. It possesses the additional feature of being direct reading. The indicating portion consists of a Stewart magnetic speedometer connected to the cup spindle by suitable gear wheels. The object of employing three cups in this case was

*See *Meteorological Magazine* 62 (1927), p. 160.

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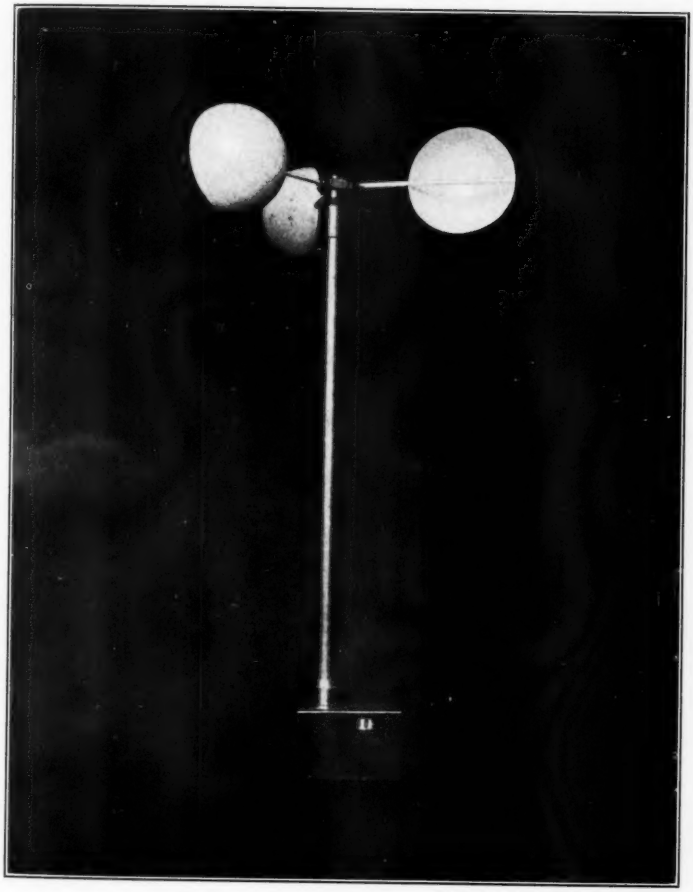


THREE-CUP ANEMOMETER

to make the correction to the observed readings as small as possible by virtue of the comparatively constant "factor" of the three-cup instrument. It is clear, however, that the best procedure would be to graduate the indicator scale directly from the calibration figures for the head.

The instrument shown in the photograph possesses 5-in. cups on 6·3-in. arms, and is provided with a cone and cup ball bearing at the top.

Since making this instrument we have learnt that Messrs. Elliott Brothers of Westminster make a somewhat similar direct reading anemometer with four cups.

E. L. DAVIES.
N. K. JOHNSON.

Porton, Wilts. August 30th, 1927.

[Messrs. Short and Mason, Walthamstow, have also produced three-cup anemometers with ball bearings. An illustration of the standard Meteorological Office pattern indicating anemometer with four cups will be found in "Observer's Handbook," Plate I.—E. G. B.]

The Play of the Winds

The industrialisation of Mersey side is rapidly developing, and one of the signs of this growth is the large number of tall chimneys which are seen on both sides of the river. This concentration is particularly noticeable on the east, that is the Liverpool side. The city of Liverpool lies on a low plateau or platform, roughly triangular in shape, the base of which lies along the river side. The plateau is undulating but at the north and south ends at distances varying from one to three miles from the river, the land rises abruptly to a height of nearly 200 ft. The chimneys lie mainly on this plateau close to the river and are sheltered on the east by this abrupt rise of land. The topography of the city provides a stage on which the wind currents can play as they list with the smoke of the chimneys.

On Friday, June 10th, at 8 a.m. G.M.T., the play enacted by the lower air currents and demonstrated by the smoke of these chimneys was dramatic and very beautiful, as viewed from the deck of a Wallasey ferry steamer during the 10 minutes of its passage from Seacombe to Liverpool. The smoke from the north end of the plateau, from the neighbourhood of Seaforth, moved southwards towards Liverpool; the smoke from the south end, from the neighbourhood of Dingle Point, moved north towards Liverpool. The two opposing air currents met about one mile north from the Liverpool Town Hall; within this central area of meeting, which was about half a mile in extent, the smoke rose perpendicularly. Above it hung a dense black cloud. The

silence and gentleness of these air movements added greatly to the impressiveness of the scene. The wind was light and no rain fell. From a study of the Daily Weather Maps (British and International Sections) it is clear that during the few days immediately preceding Friday, June 10th, the British Isles was the meeting place of dissimilar pressure zones. On Thursday the 9th the east and north shores were covered by the rear of a Scandinavian cyclone; the south west areas were on the north margin of an anticyclone; from the Icelandic area another anticyclone was pushing its way to the south-east, while a second cyclone was moving east towards south Ireland and the Bay of Biscay. The Irish sea. the Midlands and south-east England offered a narrow transitional zone between these conflicting areas. On Friday two islands of high pressure formed within this zone; one lay over the North Channel the other over the Fenland region. A north-westerly wind had dominated England for two days and reinforced by the high pressure, over the North Channel, perhaps accounted for the northerly current which moved from Seaforth to Liverpool. On Thursday an easterly current appeared in Norfolk. It would be very interesting if it were found that the easterly current of the 9th over Norfolk, and the high pressure of the 10th over the Fenlands were related, and were responsible for the currents which carried the smoke north from Garston over Liverpool. Probably it is more likely that local variations helped to produce these opposing currents.

LILY WINCHESTER.

School of Geography, University of Liverpool. June 17th, 1927.

Ball Lightning at Cattewater

On March 23rd at 23h. 45m. G.M.T. there occurred a brilliant blue flash followed immediately by a crashing explosion resembling nothing so much as the bursting of high explosive. On the following morning a letter was inserted in the local press (*Western Morning News* and *Evening Herald*) requesting witnesses of the phenomenon to send a brief account to this office. A good deal of reliable data has been obtained and it appears certain that ball lightning was experienced. It seems evident that Cattewater was the centre of the disturbance as no damage is reported elsewhere and all accounts point to it being the centre. In Plymouth and neighbouring districts, a very vivid flash (blue) followed immediately by a very heavy explosion was observed.

The manager of the local Navy, Army and Air Force Institute, at Cattewater, reports that at 12h. 45m. he and his wife observed a " ball of fire of a greenish blue colour and about three times the size of a football sink past their bedroom window and two or

three seconds later ascend to about 6 ft. and explode." The building shook and much plaster came down. Sparks were noticed flying from the ball before the explosion. After, a pungent smell of sulphur was observed.

Damage done to the camp was as follows :—

1. Most electric lights fused and in one case a main switch protected by an iron shield was blown to bits.

2. About nine inches was blown off the top of the mast carrying the wind sleeve, on the round tower. Two holes about 4 inches deep and about the size of saucers were made in the solid concrete roof of the tower. Two steel guys supporting the mast were snapped. The wind at the time was about 23 m.p.h. with a gust at 23h. 45m. of 34m. p.h., direction west.

3. A small concrete shed, the door of which was locked, and situated near the tower, had the door blown open and the lock smashed. A large hole about 10 inches in diameter was blown through the base of the northern wall—thickness of wall 6 inches. Some of the matchboard lining was torn off and a small cigarette tin was badly twisted. Much plaster fell.

Mr. G. Vigg, caretaker R.N. Dockyard, Turnchapel, about 1¼ miles south-east of Cattewater, reports seeing at 12h. 44m. a ball of flame about three times the size of a football coming from due south and revolving with sparks shooting from it. He immediately went indoors and just had time to close the door when a terrific explosion occurred. The building shook and the telephone bell started ringing. The village constable who was out of doors and within 50 yards was knocked down. Both report a smell of sulphur after the explosion.

Mrs. Dodd, living some 1½ miles north-west of Cattewater, at Stoke, reports " following the loud noise of an explosion there appeared a mass in the sky about three times the size of a football, of a red and yellow colour which appeared to be revolving as it made its travelling from south to north-east."

Rain and hail showers were frequent during the evening of the 23rd and were followed by continuous rain. All observers state that the wind was west or nearly so. At 23h. 5m. temperature rose 2° F., and at 23h. 50m. fell 4° F.

W. L. ANDREW.

Cattewater, Plymouth. March 29th, 1927.

Earth Tremor at Amman, Transjordan, July 11th, 1927

At about 13h. 10m. G.M.T. a succession of three earth tremors were experienced, the three together lasting for a duration of from one to one and a half minutes and causing considerable damage to surrounding districts.

It seemed that, without warning, the floor began to heave, and the buildings swayed, this no sooner became apparent than a second shock, even more severe, made itself felt, the floor being not unlike the deck of a ship in a rough sea, and yet a third tremor disturbed us, the whole earth seemed alive, walls of buildings cracked, masonry fell, huge rocks, displaced by the shock, rolled down amid clouds of dust into the Wadi, taking everything within their path.

From the village of Amman huge clouds of dust arose, from which it is gathered a considerable amount of damage has been caused. Some damage was done to the meteorological instruments, especially the microbarograph and anemobiagraph, while the barograph, thermograph and hygrograph showed traces of the shock.

C. FALCONER.

Meteorological Section, R.A.F., Amman, Transjordan.

NOTES AND QUERIES

Note on the Highland and Agricultural Show. Edinburgh, July 26th—29th, 1927

The useful purpose served by the meteorological exhibit at the Highland and Agricultural Show in Glasgow, 1925, encouraged a repetition this year when the show was held at Edinburgh.

In addition to the usual display, material comprising meteorological instruments, autographic records, synoptic charts and the much admired collection of cloud photographs belonging to Mr. G. A. Clarke, Aberdeen, a series of large scale diagrams depicting the structure and life history of a depression according to the Bergen School were specially prepared at the Edinburgh Office. The general interest shown in these diagrams by all visitors to the exhibit, and the attention paid to demonstrations of the receipt of synoptic information and the preparation and issue of forecasts, gave ample evidence of the increasing regard for meteorological work in Scotland. There was more than one instance of a visitor returning to the exhibit with the remainder of his family in order that all might learn about the much broadcasted depression.

Remarks made by farmers to the effect that their activities are largely controlled by the forecast of the previous evening were very common. The opinion was equally frequently expressed that south-east England seemed to have all the weather of the British Isles; Scotland had to be content with the remainder. One farmer from the extreme west of Argyllshire, on the other hand, explained that the Air Ministry forecasts were of little use to him for a different reason. On many

occasions of the approach of a depression he had already established a fair acquaintance with the quality of its warm front before its existence was indicated by the evening bulletin.

Association of Special Libraries and Information Bureaux

The Fourth Conference of this Association will meet at Trinity College, Cambridge, on September 23rd to 26th, when it is expected that some 200 organisations will be represented. Following a reception by Sir J. J. Thomson, O.M., Master of Trinity, the Presidential Address will be delivered by Sir Geoffrey Butler, K.B.E. Sir Henry Lyons will speak on "Recent developments in connexion with the Science Library, South Kensington," and Sir Richard Gregory on "Standards of book selection in science and technology"; other subjects dealt with will include "Printing, reprinting and abstracting scientific literature; possible economies" and "The Special Library from the administrative standpoint, with special reference to methods of indexing and filing." The Conference is open to all interested, whether members of the Association or not; a copy of the detailed programme and other particulars can be obtained from the Secretary, ASLIB, 38, Bloomsbury Square, London, W.C. 1.

Meteorological Conditions on German Air Routes

During the summer a series of brief publications has been received from the Aeronautical Observatory, Lindenberg, Berlin, dealing with meteorological features of special interest or importance to the air routes operated in different parts of Germany. These notes have been prepared by the local meteorologists who are responsible for the supply of weather information to the company operating these routes, and who are familiar with the orographical features of the districts flown over and the weather phenomena peculiar to these districts. The series promises to be particularly useful to the aircraft company, the pilots and the meteorologists themselves.

Rain Falling through Drizzle

It is known that rain sometimes falls through drizzle, but until quite recently no information has been available as to the frequency of the phenomenon in this country.

Since December 1st, 1926, however, observers at the Meteorological Office stations have had instructions to take particular notice of the details of such phenomenon and submit a report

after two months' observations, viz., December, 1926, and January, 1927. A tabular summary of extracts of these reports is set out below.

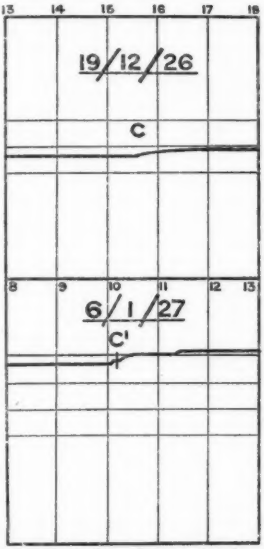
Station.	Date.	Time of occurrence of the phenomenon.	Remarks.
Felixstowe ...	19.12.26	15h. 30m. For a few minutes.	(See report below).
Felixstowe ...	6.1.27	10h. and 10h. 8m. For a few minutes.	(See report below).
Croydon	26.1.27	10h.	Continuous light drizzle with occasional rain.
Lympne	6.12.26	12h. 50m.	Observation confirmed by other members of the staff.
Lympne	3.1.27	17h.—17h. 30m.	Drizzle occurred during continuous light rain.
Holyhead ...	5.12.26	15h.—15h. 15m.	Uniform layer of cloud at 500 ft. Drizzle ceased after rain.
Holyhead ...	8.1.27	6h. 50m.—8h.	Intermittent rain through drizzle.
Renfrew	9.1.27	7h. 15m.	$\frac{10}{10}$ths nimbus rain through continuous slight drizzle.
Worthy Down ...	12.1.27	17h.—18h.	Rain through slight continuous drizzle. Strong S wind which veered sharply from S by W to SW at 21h. 20m.
Worthy Down ...	18.3.27	6h. 45m.—6h. 55m.	(See report below).

The second report from Lympne is noteworthy as being the only occasion on which the drizzle occurred after rain had set in. In all other instances the rain occurred during a period of drizzle. The longest period during which the phenomenon persisted is reported from Holyhead where intermittent rain fell through drizzle from 6h. 50m. to 8h. on January 8th, 1927. The two Felixstowe cases have been investigated rather closely and the fuller report, which includes autographic records for the station, is as follows :—

Two occasions of rain falling through drizzle have been recorded during the past two months.

(1) December 19th, 1926.

Sky half covered with strato-cumulus and alto-cumulus at 14h. 20m. This stratus approached from the west and light drizzle commenced at 14h. 30m. with a fair sky which became covered with stratus at about 14h. 40m. This disappeared again at 16h. 40m. when drizzle ceased. Rain fell through the drizzle for a short period at 15h. 30m. Wind on the surface at that time was westerly, force 3. Barometer falling slightly 13h. to 15h. then steady.



Record of Hyetograph at FELIXSTOWE.

(2) January 6th, 1927.

Sky very cloudy with strato-cumulus at 7h., developed into stratus (3,000 feet) by about 8h. 30m. and lowering to about 1,500 feet when drizzle commenced at 9h. 10m. and ceased temporarily at 11h. 30m. Rain fell through drizzle for a few minutes at 10h. and again at 10h. 8m. Wind on the surface SW force 2 at 7h., backing to S by 10h. and increasing to force 4. Barometer falling continuously.

The charts and autographic records for the two days in question have been investigated for the position and travel of "fronts" and in both cases the phenomenon seems to be associated with the arrival of a kind of minute cold front in between the arrivals of the two more pronounced warm fronts. On the surface, the temperature drop in each case was very small but very definite and similar. It is thought that this drop of 1° F., roughly, in each case is only a slight indication of perhaps a greater drop at higher levels. The wind charts also bear great resemblance in that in both cases the phenomenon occurred at the end of a small backing of the wind and shortly after the wind on the surface had increased and reached the steady stage. In both cases the hyetograph chart shows clearly, at C and C^1, the arrival of the rain after the drop of temperature. Drizzle was persistent throughout the whole process. An examination of the weather charts at the nearest fundamental hours on both occasions discloses quite clearly the presence of the two warm fronts referred to above.

It would be interesting to know whether an investigation of

the phenomenon occurring at the other stations would bring out similar features.

In conclusion, it should be noted that at no two stations is the phenomenon reported approximately at the same time or even on the same day. This would lead one to suppose that the process is a local one and not necessarily a phenomenon which persists and travels with the warm fronts. C. W. LAMB.

The following additional particulars regarding the occurrence at Worthy Down have been supplied by Mr. C. V. Ockenden.

The observer's direction of motion was northwest to southeast, up and over a bare saddle-back ridge running east and west. The wind at the time was SSE 5—8 m.p.h. A 4—6 minute periodicity in intensity of rainfall is just discernible on the hyetogram, and this has been noticed before (*e.g.*, 3h.—4h. on March 4th, 1927) in air of equatorial origin. Small changes of wind direction occur with the same order of frequency, indicative of minor "whirls" associated with up-currents between the ground and the cloud layer (500 feet in the present instance).

On the morning of March 18th, during a ten-minute walk across the aerodrome between 6h. 45m. and 6h. 55m. G.M.T., rain was noticed falling through drizzle in two separate "waves," in this way: To start with, continuous drizzle only was falling; within the first half-minute drops of rain intruded themselves, gradually increasing in number for about 1½ minute until precipitation fell in the proportion (approx.) 70 per cent. rain and 30 per cent. drizzle. This maximum was maintained for about ½ minute, and then the amount of rain diminished gradually, until drizzle only was falling. The whole "wave" occupied a space of about 4 minutes, and was repeated.

A New Catalogue of Standard Thermometers by Negretti & Zambra

A new catalogue of standard thermometers has recently reached us from Messrs. Negretti & Zambra. The catalogue is well illustrated and very comprehensive, numerous alternative patterns being shown for ordinary, maximum, minimum, grass minimum and earth thermometers. For each of these classes of instruments, the Meteorological Office standard pattern is included. Under the heading of hygrometers, the reader is offered a choice of several instruments alternative to the ordinary wet and dry bulb exposed in a Stevenson screen. Two types of whirling hygrometer are shown as well as the Assmann psychrometer, Regnault's, Daniell's and Dines's hygrometers.

In the section on recording thermometers and hygrometers, the mercury-in-steel transmitting thermometer, in which this firm has specialised, takes the leading place. Besides their obvious use of providing a continuous reading of the dry and

wet bulb records, twin pen instruments are also readily adaptable for recording soil temperatures at two different depths. The most ambitious instrument illustrated in the catalogue is, however, the aspirated wet and dry bulb recorder in which the mercury transmission principle is adopted, and in addition a fan, driven by a small motor, is included to aspirate a continuous current of air over the bulbs after the manner of the Assmann psychrometer. The use of this instrument seems to offer the best alternative at present available to the expensive photographic wet and dry bulb recorders installed at British Observatories.

Not the least interesting feature of the catalogue is the historical introduction followed by notes on manufacture. The reader will gain much interesting information relating to thermometers from this section.

E. G. B.

Weather and Life

We have received a set of numbers of a popular but scientific meteorological periodical published by the Ukraine Meteorological Service under the above title. This magazine, which is similar in its scope to the *Meteorological Magazine* or *Das Wetter*, is prepared by the voluntary work of a number of collaborators among the staff of the Ukraine Service, and this allows it to be issued at the low price of about five shillings for twelve monthly numbers. The contents appear to be of considerable interest—we notice, for example, a long account of Bjerknes' theory of cyclones—but, being entirely in the language of the Ukraine, are not likely to appeal to many English readers.

Angoran Meteorological Service

In 1925 a meteorological service for Angora was organised under the authority of His Excellency Sabri Bey, the Minister of Agiculture of the Turkish Republic. Dr. A. Rethly was made Director of the new service and observations were started at Angora Observatory on November 12th with the instruments donated by the Hungarian Meteorological Service.

The new service commenced its series of publications with the issue of Monthly Weather Reports for November and December, 1925, containing daily observations at 7h., 14h. and 21h. for the Observatory at Angora. In 1926 the work of the service was considerably extended and many new stations were established. The report for 1927 contains in addition to the full observations for Angora, temperature, cloud and rainfall for 12 stations and data from 39 rainfall stations.

Reviews

Typen van den Regenval in Nederlandsch-Indië. By Dr. J. Boerema. Kon. Magn. Meteor. Obs. Batavia. Verh. No. 18, Size 11×7, pp. iv.+58 (Dutch)+54 (English). *Illus.* Batavia, 1926.

The subject matter of this publication is not completely defined by the title "Rainfall types in the Netherlands Indies," it being only the types of the distribution of average monthly rainfall throughout the year which are discussed. The treatment of the subject is similar to that adopted by Prof. G. Hellmann when dealing with the rainfall of Europe.*

The general features of the climate of the Archipelago were discussed in Vol. 1 of this series, where maps were published showing the months of the greatest and least rainfall†. In the present publication two maps are reproduced. That of Sumatra, Borneo and Celebes is on the scale of 1 : 2,500,000 (40 miles to 1 inch) and that for Java and Madura on the scale of 1 : 500,000 (8 miles to 1 inch). Each map is divided into zones, for each of which the average monthly rainfall in millimetres is shown diagramatically, a correction being applied so that the length of each month can be counted as 30 days. The division is naturally somewhat arbitrary since the variation in the rainfall is gradual. In all 153 types are discussed.

In considering the causes of the variation from place to place it is important to realise that the islands cover a considerable area, extending from latitude 5° N to 10° S and from longitude 95° E to 140° E. The distribution of the rainfall in each zone is considered in relation to three factors :—

(A) Though the whole area experiences a high temperature the ascension of air is not uniform. The highest temperature follows, with some retardation, the variation in the sun's declination. Near the equator maxima occur in March and September, although there is relatively a small range in the monthly amounts. With increasing latitude both northwards and southwards, the two rainy seasons approach each other, joining about 8° N and 8° S in zones with a single tropical rainy season, which occurs during the summer of the relative hemisphere.

(B) The monsoon rains of this region originate by the alternate warming and cooling of the continents of Australia and Asia. During the southern summer the temperature over north-western

* Untersuchungen über die jährliche Periode der Niederschläge in Europa. Sitzungsberichte der Preussischen Alsadenue der Wissenschaften. March 27th, 1924.

† Het Klimat Van Nederlandsch-Indië. By C. Braak. *Kon. Magn Meteor. Obs., Batavia.* Verh. No. 8, Vol. 1., Part III. (Reviewed in the *Meteorological Magazine,* 58, 1923, p. 265).

Australia rises, the air ascends and the south-east trade wind is replaced by the north-west monsoon. At the same time there is a high pressure over Asia and the outflowing air reinforces the north-east trade wind as a north-east monsoon, and passing over the equator changes gradually into the north-west monsoon. When the sun is north of the equator the wind system is reversed, but as the air moves over a short distance of sea it becomes less moist than in the previous case. Moreover, it is a descending rather than an ascending current and therefore less likely to produce rain.

(c) The third factor is that of the orography of the land, which tends to accentuate the differences in the monthly rainfall which have already been discussed.

A brief mention may be made of some of the actual types. In the mountainous region of Central Java there is in Type 22 a wide range in the average monthly amounts from 650 mm. in January and February, at the time of the west monsoon, to 50 mm. in July and August. In Type 71 the rainfall in each of the three months July, August and September, is less than 10 mm. The area concerned is the southern half of the island of Timor, which is one of the islands nearest to the continent of Australia. Near Singapore, in Type 33, 1,500 miles to the north-west of Timor, more than 230 mm. of rain occurs in each of these three months. The distribution of the rainfall throughout the year is discussed for each of the 153 zones in relation to the factors enumerated above. J. G.

Anales del Observatorio Nacional de San Bartolomé en los Andes Colombianos. Observaciones meteorologicas de 1924. Bogota. 1927.

This forms the second annual volume of observations published by the meteorological service of Colombia* since the inauguration of the new observatory at Bogota in September, 1922. The first annual volume dealt exclusively with the values of the various elements for Bogota, but this new volume contains, in addition, data of the rainfall and the mean and extreme temperature for each month at four secondary stations, Tunja, Pasto, Bucaramange and Ibague, together with the rainfall at three other stations. Father Sarasola is to be congratulated on the continued progress made by this new meteorological service.

The Weather of August, 1927

The most striking feature of the weather of the month was the excessive rainfall in most districts except for the north of Scotland. On the 1st (Bank Holiday) rain fell continuously in

* See *Meteorological Magazine* 60 (1925), p. 172.

many parts of southern England though fairer conditions prevailed in the west and north. During the next few days an anticyclone moved across our islands to Scandinavia giving generally warm sunny weather though local thunderstorms began to develop on the 5th—6th. By this time a depression was approaching southwest Ireland and from then onwards until near the end of the month our weather was dominated by a succession of depressions which passed over or very near the British Isles giving unsettled weather (except in north Scotland) with many bright intervals. Rain fell on most days and local thunderstorms occurred frequently. Amongst some of the heaviest falls may be mentioned 2·15 in. at Mallarany (Mayo) on the 6th, 2·28 in. at Harrogate and 2·22 in. at Marchmont (Berwick), both on the 8th, on which date over 1·5 in. fell in several parts of northeast England and southeast Scotland. Arlington (Devon) had 1·61 in. on the 11th followed by 1·30 in. on the 12th. On the 14th Mallarany again had 2·73 in., Claerwen (Radnor) had 2.95 in. on the 15th and Llanddeusant (Carmarthen) 2·20 in. on the 21st. After the 24th the depressions passed to the north of the British Isles giving unsettled weather in the north while pressure was high over England with a consequent improvement of the weather there. With the exception of isolated heavy falls in Wales on the 27th, when as much as 3·87 in. were measured at Cwm Dyli, Snowdon, the rainfall was not heavy. In southeast England little or no rain fell for several days and temperature rose considerably, the last day being in some parts of the south the hottest during the month. Only twice was 80° F. reported during the month, at Cullompton on the 5th and at Cranwell on the 6th. Strong winds were experienced at times in the English Channel during the second half of the month while gale force was reached on a few occasions, notably on the 22nd. In the north of Scotland the month was generally fair and sunny, the total rainfall being below normal and the sunshine above normal.

Pressure was below normal over western Europe, Iceland and part of the North Atlantic, the greatest deficit being 5·9 mb. at Birr Castle (Ireland), and above normal over Spitsbergen, eastern and northern Scandinavia, Italy, Spain, Newfoundland and Bermuda. Temperature was above normal except in Switzerland, Germany and Portugal, and rainfall was above normal except in parts of eastern and northern Scandinavia; in southern Sweden it was as much as double the normal.

Throughout the month storms and heavy rains accompanied by floods were continually reported from central, Europe the worst storms being over Switzerland on the 2nd, when much damage was done in the Cantons of Berne and Vaud, and over

Switzerland, southeast France and the districts round Cologne on the 11th, when waterspouts were seen in the Jura and Lake Geneva regions. A landslide occurred on the 21st in the Bernese Oberland owing to the heavy rains. Heavy rains caused floods near Bruges on the 22nd, and floods occurred in eastern Siberia from the 17th to 23rd, when 100 people were drowned. The severe storms during the night of the 30th—31st caused heavy floods in eastern Galicia and 180 people were drowned in the valleys. In south France and Italy meanwhile drought prevailed during most of the month. From the 10th—28th forest fires raged intermittently on the French Riviera, on the 17th and 18th forest fires fanned by strong winds swept across parts of Corsica, and on the 18th a forest fire lasting 24 hours was reported near Alassio on the Italian Riviera. On the 28th a violent storm occurred in northeast Italy and snow fell on the Alps down to a level of 4,200 ft. and on the Dalmatian mountains.

By the 12th the disastrous floods in the Kathiawar Peninsula mentioned on p. 169 of the August magazine had subsided. A launch with about 40 people on board was destroyed by a typhoon in Manila Harbour on the 19th and a typhoon swept across Hongkong on the 21st. It was reported on the 29th that torrential autumnal rains, which had occurred unusually early in the season, had caused 51 deaths, mostly by landslides, and widespread floods in Kyushu and Shikoku, Japan.

As a result of the severe drought on the borders of Portuguese East Africa and on the Komatipoort district there was an invasion of Swaziland by herds of wildebeestes.

A violent rain and thunderstorm, bringing relief from the heat wave, swept across New York and the neighbourhood on the 1st, and the mean temperature for the month was generally below normal for the eastern and central States. Light frosts occurred early in the month in Saskatchewan and parts of Manitoba and Alberta. A severe storm passed over Nova Scotia about the 24th, twelve people being killed.

The special message from Brazil states that the rainfall in the northern regions was 52 mm. below the normal, and that in the central and southern regions the distribution was irregular with totals equal to normal and 13 mm. above normal respectively. Five anticyclones passed across the country. In the south depressions were numerous with frequent high winds. Crops were generally in good condition. At Rio de Janeiro pressure was 1·7 mb. below normal, and temperature 0·2° F. below normal.

Rainfall, August, 1927—General Distribution

England and Wales ..	155	per cent. of the average 1881-1915.
Scotland	121	
Ireland	126	
British Isles	140	

Rainfall: August, 1927: England and Wales

CO.	STATION.	In.	Per-cent. of Av.	CO.	STATION.	In.	Per-cent of Av.
Lond.	Camden Square	3·97	180	*Leics*	Thornton Reservoir ..	3·31	118
Sur .	Reigate, The Knowle ..	5·03	218	,, .	Belvoir Castle	2·09	80
Kent.	Tenterden, Ashenden..	3·91	171	*Rut* .	Ridlington	4·37	...
,, .	Folkestone, Boro. San.	3·91	...	*Linc.*	Boston, Skirbeck	3·72	156
,, .	Margate, Cliftonville ..	2·79	145	,, .	Lincoln, Sessions House	2·71	110
,, .	Sevenoaks, Speldhurst.	4·94	...	,, .	Skegness, Marine Gdns.	4·56	187
Sus .	Patching Farm	5·61	222	,, .	Louth, Westgate	5·39	192
,, .	Brighton, Old Steyne .	4·03	185	,, .	Brigg	...	...
,, .	Tottingworth Park	5·81	215	*Notts.*	Worksop, Hodsock	3·77	154
Hants	Ventnor, Roy. Nat. Hos.	3·13	157	*Derby*	Mickleover, Clyde Ho..	3·35	123
,, .	Fordingbridge, Oaklnds	3·85	146	,, .	Buxton, Devon. Hos...	5·88	134
,, .	Ovington Rectory	3·90	144	*Ches.*	Runcorn, Weston Pt...	5·23	145
,, .	Sherborne St. John ...	2·63	109	,, ..	Nantwich, Dorfold Hall	4·55	...
Berks	Wellington College ...	3·46	149	*Lancs*	Manchester, Whit. Pk.	4·06	118
,, .	Newbury, Greenham ..	3·54	135	,, ..	Stonyhurst College	7·13	141
Herts.	Benington House	...	...	,, ..	Southport, Hesketh Pk	5·21	150
Bucks	High Wycombe	5·15	222	,, ..	Lancaster, Strathspey.	6·55	...
Oxf. .	Oxford, Mag. College ..	3·97	177	*Yorks*	Wath-upon-Dearne ...	5·15	214
Nor .	Pitsford, Sedgebrook ..	3·41	141	,, .	Bradford, Lister Pk...	5·54	204
,, .	Oundle	2·98	...	,, .	Oughtershaw Hall	10·54	...
Beds.	Woburn, Crawley Mill .	3·19	138	,, .	Wetherby, Ribston H..	5·56	204
Cam.	Cambridge, Bot. Gdns.	2·46	105	,, .	Hull, Pearson Park ...	5·65	194
Essex	Chelmsford, County Lab	3·96	183	,, .	Holme-on-Spalding ...	3·03	...
,, .	Lexden, Hill House ...	2·62	...	,, .	West Witton, Ivy Ho..	7·81	...
Suff .	Hawkedon Rectory ...	2·69	104	,, .	Felixkirk, Mt. St. John	5·65	198
,, .	Haughley House	4·12	...	,, .	Pickering, Hungate ...	5·83	...
Norf.	Beccles, Geldeston	2·72	126	,, .	Scarborough	...	...
,, .	Norwich, Eaton	3·35	142	,, .	Middlesbrough	4.69	171
,, .	Blakeney	3.53	156	,, .	Baldersdale, Hury Res.	7·32	...
,, .	Little Dunham	3·31	122	*Durh.*	Ushaw College	5·96	205
Wilts.	Devizes, Highclere	4·62	161	*Nor* .	Newcastle, Town Moor.	5·30	200
,, .	Bishops Cannings	4·44	143	,, .	Bellingham, Highgreen	7·00	...
Dor .	Evershot, Melbury Ho.	4·25	135	,, .	Lilburn Tower Gdns..	5·19	...
,, .	Creech Grange	4·17	...	*Cumb*	Geltsdale	5·86	...
,, .	Shaftesbury, Abbey Ho.	4·34	149	,, .	Carlisle, Scaleby Hall .	5·26	128
Devon	Plymouth, The Hoe ...	3·42	111	,, .	Seathwaite M.	...	...
,, .	Polapit Tamar	3·12	98	,, .	Keswick	6·11	...
,, .	Ashburton, Druid Ho..	4·37	117	*Glam.*	Cardiff, Ely P. Stn.....	5·38	125
,, .	Cullompton	2·67	88	,, .	Treherbert, Tynywaun	14·14	...
,, .	Sidmouth, Sidmount ..	2·99	106	*Carm*	Carmarthen Friary	7·92	170
,, .	Filleigh, Castle Hill ...	5·07	...	,, .	Llanwrda, Dolaucothy.	10·11	184
,, .	Barnstaple, N. Dev. Ath.	5·03	152	*Pemb*	Haverfordwest, School	6·92	166
Corn.	Redruth, Trewirgie ...	4·31	126	*Card.*	Gogerddan	7·58	156
,, .	Penzance, Morrab Gdn.	3·76	119	,, .	Cardigan, County Sch. .	5·64	...
,, .	St. Austell, Trevarna ..	4·56	126	*Brec.*	Crickhowell, Talymaes	8·70	...
Soms	Chewton Mendip	6·08	135	*Rad* .	Birm. W. W. Tyrmynydd	10·38	193
,, .	Street, Hind Hayes ...	3·34	...	*Mont.*	Lake Vyrnwy	9·01	174
Glos. .	Clifton College	4·15	119	*Denb.*	Llangynhafal	6·07	...
,, .	Cirencester, Gwynfa ..	4·88	163	*Mer* .	Dolgelly, Bryntirion ..	10·53	187
Here.	Ross, Birchlea	4·89	191	*Carn.*	Llandudno	6·83	226
,, .	Ledbury, Underdown.	4·98	191	,, .	Snowdon, L. Llydaw 9	23·95	...
Salop	Church Stretton	6·51	200	*Ang* .	Holyhead, Salt Island.	5·89	185
,, .	Shifnal, Hatton Grange	3·89	138	,, .	Lligwy	6·26	...
Worc.	Ombersley, Holt Lock.	4·48	167	*Isle of Man*	Douglas, Boro' Cem...	5·56	146
,, .	Blockley, Upton Wold.	4·18	142	*Guernsey*	St. Peter P't. Grange Rd	3·04	129
War.	Farnborough	3·67	134				
,, .	Birmingham, Edgbaston	3·74	138				

Rainfall: August, 1927: Scotland and Ireland

CO.	STATION	In.	Per-cent. of Av.	CO.	STATION.	In.	Per-cent of Av.
Wigt.	Stoneykirk, Ardwell Ho	4·17	111	*Suth.*	Loch More, Achfary...	5·65	97
„ .	Pt. William, Monreith .	3·64	...	*Caith*	Wick	...	...
Kirk.	Caraphairn, Shiel.	7·72	...	*Ork .*	Pomona, Deerness	1·23	43
„ .	Dumfries, Cargen.....	7·15	163	*Shet .*	Lerwick	1·25	41
Roxb	Branxholme	5·71	177	*Cork.*	Caheragh Rectory	5·16	...
Selk .	Ettrick Manse.....	7·22	...	„ ..	Dunmanway Rectory.	5·23	111
Berk.	Marchmont House	7·94	240	„ ..	Ballinacurra	4·58	123
Hadd	North Berwick Res....	6·10	193	„ ..	Glanmire, Lota Lo.	5·98	164
Midl	Edinburgh, Roy. Obs..	6·79	220	*Kerry*	Valentia Obsy.	4·89	102
Lan .	Biggar	...	...	„ .	Gearahameen	10·30	...
„ .	Leadhills	...	...	„ .	Killarney Asylum.....	7·17	162
Ayr .	Kilmarnock, Agric. C..	4·08	104	„ .	Darrynane Abbey	6·04	139
„ .	Girvan, Pinmore.....	3·24	73	*Wat .*	Waterford, Brook Lo..	4·27	112
Renf.	Glasgow, Queen's Pk..	5·69	161	*Tip .*	Nenagh, Cas. Lough....	4·22	107
„ .	Greenock, Prospect H..	6·86	126	„ .	Roscrea, Timoney Park	5·66	...
Bute.	Rothesay, Ardencraig.	4·53	93	„ .	Cashel, Ballinamona ..	4·85	137
„ .	Dougarie Lodge	2·74	...	*Lim .*	Foynes, Coolnanes	3·46	90
Arg .	Ardgour House	7·59	...	„ .	Castleconnell Rec.	3·83	...
„ .	Manse of Glenorchy..	8·12	...	*Clare*	Inagh, Mount Callan ..	6·47	...
„ .	Oban	5·29	...	„ .	Broadford, Hurdleat'n.	5·73	...
„ .	Poltalloch	7·13	146	*Wexf*	Newtownbarry	5·32	...
„ .	Inveraray Castle.....	8·52	130	„ .	Gorey, Courtown Ho...	4·82	145
„ .	Islay, Eallabus.....	3·26	75	*Kilk.*	Kilkenny Castle	3·93	113
„ .	Mull, Benmore	9·02	...	*Wic .*	Rathnew, Clonmannon	4·24	...
Kinr.	Loch Leven Sluice	7·10	185	*Carl .*	Hacketstown Rectory .	6·21	153
Perth	Loch Dhu	...	...	*QCo..*	Blandsfort House.....	6·38	161
„ ..	Balquhidder, Stronvar.	8·09	...	„	Mountmellick	4·90	...
„ ..	Crieff, Strathearn Hyd.	6·68	159	*KCo .*	Birr Castle	4·29	110
„ ..	Blair Castle Gardens ..	4·25	126	*Dubl.*	Dublin, FitzWm. Sq...	6·81	224
Forf.	Kettins School.....	4·50	136	„ .	Balbriggan, Ardgillan .	4·77	140
„ .	Dundee, E. Necropolis.	5·58	165	*Me'th*	Beauparc, St. Cloud ..	4·43	...
„ .	Pearsie House.....	5·02	...	„ .	Kells, Headfort.....	4·27	103
„ .	Montrose, Sunnyside..	3·19	114	*W.M*	Moate, Coolatore.....	5·18	...
Aber.	Braemar, Bank	3·42	100	„ .	Mullingar, Belvedere .	5·07	122
„ .	Logie Coldstone Sch. ..	5·21	164	*Long*	Castle Forbes Gdns....	4·67	114
„ .	Aberdeen, King's Coll..	2·26	83	*Gal .*	Ballynahinch Castle ..	8·81	161
„ .	Fyvie Castle	2·03	...	„ .	Galway, Grammar Sch.	5·36	...
Mor .	Gordon Castle.....	2·06	65	*Mayo*	Mallaranny.....	10·97	...
„	Grantown-on-Spey	3·65	114	„ .	Westport House.....	7·29	180
Na .	Nairn, Delnies.....	3·05	127	„ .	Delphi Lodge	10·37	...
Inv..	Ben Alder Lodge	3·75	...	*Sligo*	Markree Obsy.	7·31	168
„ .	Kingussie, The Birches	4·26	...	*Cav'n*	Belturbet, Cloverhill..	4·30	116
„ .	Loch Quoich, Loan	7·40	...	*Ferm*	Enniskillen, Portora ..	...	...
„ .	Glenquoich	6·83	83	*Arm.*	Armagh Obsy.	4·46	123
„ .	Inverness, Culduthel R.	3·83	...	*Down*	Fofanny Reservoir ...	6·67	...
„ .	Arisaig, Faire-na-Squir	3·60	...	„ .	Seaforde	3·97	106
„ .	Fort William.....	7·05	114	„ .	Donaghadee, C. Stn...	3·52	106
„ .	Skye, Dunvegan.....	4·01	...	„ .	Banbridge, Milltown .	4·57	131
„ .	Barra, Castlebay	...	...	*Antr.*	Belfast, Cavehill Rd. .	3·43	...
R&C	Alness, Ardross Cas. ..	3·76	127	„ .	Glenarm Castle.....	3·83	...
„ .	Ullapool.....	2·65	...	„ .	Ballymena, Harryville	3·08	72
„ .	Torridon, Bendamph..	5·19	79	*Lon .*	Londonderry, Creggan	3·89	84
„ .	Achnashellach	5·72	...	*Tyr .*	Donaghmore	4·06	...
„ .	Stornoway	2·72	69	„ .	Omagh, Edenfel	3·63	85
Suth.	Lairg	1·90	...	*Don .*	Malin Head	3·05	87
„ .	Tongue Manse.....	2·88	99	„ .	Dunfanaghy	4·94	112
„ .	Melvich School.....	1·58	53	„ .	Killybegs, Rookmount.	6·30	113

Climatological Table for the British Empire, March, 1927

STATIONS	PRESSURE		TEMPERATURE							Relative Humidity	Mean Cloud Am'nt	PRECIPITATION			BRIGHT SUNSHINE	
	Mean of Day M.S.L.	Diff. from Normal	Absolute		Mean Values				Mean Wet Bulb.			Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible
			Max.	Min.	Max.	Min.	½ max. and min.	Diff. from Normal								
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0—10	in.	in.			
London, Kew Obsy.	1007·5	− 5·9	65	31	52·5	40·5	46·5	+ 4·1	41·0	87	6·7	2·19	+ 0·50	17	3·8	32
Gibraltar	1022·0	+ 5·0	69	45	63·0	51·7	57·3	− 0·2	50·8	80	4·8	0·94	− 3·85	9	...	...
Malta	1016·3	+ 1·5	74	50	62·3	54·0	58·1	+ 1·0	54·4	82	6·0	1·22	− 0·26	6	6·6	56
St. Helena	1012·3	+ 2·9	71	57	68·5	61·6	65·1	− 1·7	63·0	94	3·5	4·41	− 0·53	20	...	...
Sierra Leone	1011·5	+ 0·8	91	72	88·9	75·1	82·0	− 0·4	76·0	74	4·0	0·22	− 0·94	3	...	...
Lagos, Nigeria	1007·6	− 1·8	89	69	88·4	74·7	81·5	− 1·8	78·5	82	7·8	2·78	− 0·96	6	...	...
Kaduna, Nigeria	1014·9	+ 3·8	99	...	93·9	...	...	...	72·9	72	...	0·00	− 0·44	0	...	...
Zomba, Nyasaland	1009·5	− 0·2	84	...	78·7	...	...	...	.	80	8·2	7·12	− 1·70	19	...	...
Salisbury, Rhodesia	1010·7	− 0·8	81	48	76·8	56·4	66·6	− 1·6	60·8	72	5·3	2·13	− 2·37	12	7·4	61
Cape Town	1015·1	+ 0·6	101	51	81·5	59·1	70·3	+ 2·2	60·2	76	3·5	0·33	− 0·58	3	...	...
Johannesburg	1014·6	+ 0·5	85	46	72·6	52·9	62·7	− 0·6	55·7	71	4·0	2·96	− 1·48	14	6·6	54
Mauritius	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bloemfontein	...	...	91	50	77·1	57·3	67·2	− 0·2	59·2	74	4·2	5·17	+ 1·20	10	...	...
Calcutta, Alipore Obsy.	1009·1	− 0·8	99	54	90·5	67·0	78·7	− 1·4	68·0	80	2·0	0·16	− 1·28	1*	...	...
Bombay	1008·8	− 2·1	94	67	86·4	72·4	79·4	− 0·1	68·0	66	1·9	0·03	+ 0·01	0*	...	...
Madras	1009·1	− 1·8	94	70	90·6	74·9	82·7	+ 1·6	76·2	77	5·8	0·00	− 0·19	0*	...	...
Colombo, Ceylon	1008·5	− 1·9	90	71	87·7	74·2	80·9	− 0·4	77·6	77	7·0	5·91	+ 1·24	22	5·7	47
Hongkong	1015·0	− 1·1	77	47	63·6	57·0	60·3	− 3·0	56·6	81	9·0	4·53	+ 1·74	13	2·1	18
Sandakan	...	...	89	74	87·5	76·1	81·8	+ 0·7	76·7	82	...	6·36	− 1·69	13	...	...
Sydney	1014·5	− 1·7	101	54	76·2	62·5	69·3	0·0	63·9	72	6·1	3·69	− 1·10	17	6·3	51
Melbourne	1016·1	− 0·9	95	41	73·1	50·4	61·7	− 2·8	55·6	59	6·3	1·34	− 0·92	8	5·9	48
Adelaide	1015·9	− 1·2	98	51	78·9	58·2	68·5	− 1·3	56·8	43	5·9	0·99	− 0·06	7	7·0	57
Perth, W. Australia	1012·8	− 2·5	86	50	76·0	60·6	68·3	− 2·8	61·0	63	7·1	1·88	+ 1·10	9	5·5	45
Coolgardie	1012·9	− 1·9	100	50	80·0	58·5	69·3	− 2·4	58·9	59	6·4	4·91	+ 4·17	7	...	...
Brisbane	1013·5	− 0·9	92	61	81·3	66·8	74·1	− 0·2	68·7	78	7·1	7·88	+ 2·32	23	5·6	46
Hobart, Tasmania	1013·7	− 0·3	81	43	63·6	49·1	56·3	− 3·1	50·7	68	7·3	1·44	− 0·26	15	5·6	46
Wellington, N.Z.	1014·0	− 3·2	76	46	68·0	56·4	62·2	+ 1·7	56·8	65	5·1	3·39	+ 0·06	12	7·3	59
Suva, Fiji	1009·1	+ 0·6	92	73	89·8	74·7	82·3	+ 2·2	77·2	79	5·5	4·48	−10·22	20	8·0	66
Apia, Samoa	1010·8	+ 1·6	88	72	85·1	74·6	79·9	+ 0·6	77·6	81	6·0	8·11	− 5·43	21	6·4	53
Kingston, Jamaica	1015·3	+ 0·4	88	63	85·9	67·1	76·5	− 0·6	65·6	83	0·1	0·42	− 0·60	1	10·0	83
Grenada, W.I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	1019·9	+ 2·9	59	10	41·7	28·6	35·1	+ 6·2	30·3	78	5·4	2·26	− 0·39	12	4·9	41
Winnipeg	1018·0	− 0·8	52	−5	35·6	19·7	27·7	+13·3	21·4	83	4·2	0·48	− 0·63	7	6·0	51
St. John, N.B.	1016·6	+ 2·4	52	11	32·8	24·1	28·5	+ 0·1	26·3	76	5·7	2·64	− 1·90	8	5·0	42
Victoria, B.C.	1018·1	+ 2·3	56	32	49·2	38·8	44·0	+ 0·8	40·5	79	6·8	1·55	− 1·00	13	5·3	45

*For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

St. John, N.B.	1016·6	+ 2·4	52	11	32·8	24·1	27·7	+ 13·5	21·4	83	4·2	0·48	— 0·63	7	6·0	51
Victoria, B.C.	1018·1	+ 2·3	56	32	49·2	38·8	44·0	+ 0·8	40·5	79	6·8	1·55	— 1·00	13	5·3	45

*For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.